No. 4.

EXPOSITION OF ERRORS

IN THE CALCULATION OF THE

BOARD OF WATER COMMISSIONERS,

WHEREOF THE

CORRECTION IS NECESSARY TO BE MADE BY VOTERS,

BEFORE A

SOUND JUDGMENT CAN BE FORMED ON THE QUESTION,

WHETHER THE

Present Plan for bringing in the Croton Water Forty Miles,

SHALL BE ADOPTED;

SPECIALLY ADDRESSED

TO OWNERS OF REAL ESTATE, MERCHANTS, AND MECHANICS.

WITH SOME

REMARKS ON THE ERIE RAIL ROAD.

"AUDI ALTERAM PARTEM."

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THE ARGUMENT.

Showing, on the contrary, from Facts,

admitted in their first report, that for about the expense of one million, and in one year, this city might be supplied generally with Rock Water, instead of waiting four, five, or six years, and expending six millions.

Moreover proving,

1. That, if it be ultimately expedient to bring in water from the Croton, the present plan of doing it in *one duct*, cannot be free from liability to interruptions:—

2. That, if the Croton is ever necessary to this city, it should be brought in on a plan the least likely to fail; and one is suggested:—

3. That, the adoption of the Croton project is the neglect of a *present certainty*, for a remote uncertainty.

TO THE

OWNERS OF REAL ESTATE,

&c.

HAVING for some time past been led to bestow attention on the subject of supplying water to this city from the sources present in the island, and being of that profession within whose province the construction of aqueducts happens to fall, the writer asks leave to lay before you a few plain reasons, Why the plan of the Water Commissioners to bring in the Croton is at the sacrifice of near and pure sources, immediately at command, and essentially necessary without loss of time. While, on the contrary, their plan, with a view to bring the expense within limits that might not be insurmountably repugnant to public sentiment, involves the *dangerous delay* of a number of years; and some uncertainty, after all, of its answering the purpose, in our climate, in the mode of structure proposed.

The *distance of the source*, which is a reason for the *surest possible method*, is thus made *the reason* for an experimental work in hydraulic masonry.

And why do the engineers and commissioners say, that *iron pipes*, as at Philadelphia, are "out of the question?" It is *because the board has determined to bring in six times as much water as the city wants!*

This city has reached that critical period of its history, when the least mistake will turn the scale of commercial ascendency in favour of Philadelphia; and yet the commissioners, instead of advising the Common Council to make use of the ample sources present, to purify the air, and prevent the interruption of business, have, in the face of experience, *depreciated this source*, which no human mind can limit, and *postponed* the defence of health an uncertain number of years, till the Croton water can be brought in! Can this be humane? Is this political economy?

You thus perceive, that the three great classes of the community addressed are, separately as well as collectively, interested in this question: *the owners of real estate*, because the island springs are a perpetual appurtenance of property, and do away the reproach that New-York has no good water; *the merchants*, because an immediate provision may save the interruption of trade; *the mechanics*, because they, least of all, can afford the *public calamity* of a cessation of business.

It is a question submitted to the good sense of every one, Whether the moment it is decided to make *immediate* use of the waters *we have*, and then to bring in as much more *as we need*, every inhabitant will not feel that this is his *permanent home*—that this city, in respect to health, surpasses Philadelphia.—On the contrary, defer this practical defence to the uncertain time and result of a *forty-mile aqueduct*, which, to be tight,

depends on the fidelity of many thousand hands; and it leaves an uncertainty on the mind as to where will finally be the *triumphant emporium.*

The *internal improvement* of the state having been confined to the centre, is found to be incapable, however useful, of *preventing* the effects of the works of Pennsylvania to concentrate the commerce of the interior on her capital.

The defence of the metropolis of New-York is mainly left to the public spirit of its inhabitants, who will unite funds in the construction of the *Erie rail-road:* and I do not know but that it may not have occurred to others, that it would obviate one of the greatest objections to a general subscription to the stock, if dividends were paid equal to interest, from the beginning chargeable, with perfect propriety, to cost. For if the division of sections were at once such as that each would open a source of revenue, and all be doing at the same time, there would soon be enough for interest. This defence of the city will be ultimately effectual, if we do not give Philadelphia the advantage of her water-works a number of years. Why? Because the line of road touches the Alleghany, where it enters our state, and flows towards Pittsburg; indicating that route to the west which Mr. Gallatin, in his Report, describes as turning the Appalachian barrier on the north at a thousand feet less elevation than that part of the mountain crossed by the canal to Philadelphia.

This noble stream, known to the writer from observation, while on the Board of Internal Improvement and subsequently, is at Hamilton 610 feet higher than at Pittsburg; and flows, while there is a good run of water, in *one inclined plane* 280 miles. The valley of the Ohio then extends *eleven hundred miles*, through the most settled part of the west.—Whatever Canada may do on the one side, or Pennsylvania on the other, *we thus command the centre.* For, although generally known that the Alleghany is a rapid and obstructed stream, all do not know of the existence of an invention which enables steam-boats to ascend its swiftest current, by an application of the power, by apparatus, to the bottom of the river. Many, as well as myself, may know that there are upwards of fifty-three rapids below the Pennsylvania line, and we cannot expect that state to assist us to remove them: but few know that mechanical ingenuity has already made that river, *in a state of nature, a high way of commerce.* And the writer deems it fortunate for New-York that some one should have anticipated this occasion, and secured the right of this improvement by contract, as an instrument without which this essential branch of our trade could not be enjoyed. But it is obvious that with it, and with the rail-road carriages, (which have been the subject of a contract by the Baltimore company with the writer,) our trade direct with the west will reach the Alleghany shore in 36 hours and Pittsburg in 12 more, whence this class of steam-boats can proceed throughout the western waters. In 48 hours we shall cut across the Pennsylvania line of communication. So that if the Ohio state canal is joined to that of Pennsylvania, (as no doubt it will be) at Pittsburg business will divide.

The tendency of all the central west is now to that point. *The valley of the Ohio actually contains three-fourths of all the western population:* and great as is the object of reaching Lake Erie, to reach the Ohio will for a long time be greater.

These remarks are applicable to the present occasion here in this way. The same invention alluded to, not yet applicable there, nor to the *counteraction of Canadian canals* by saving much in the cost of our canal to Lake Ontario, is applicable now to the navigation of the New Jersey ca-

nal, and to *lessening the difference to the Western merchant, whether he purchase in Philadelphia or New-York.* Let us suppose a company formed among the merchants of New-York to lessen the expense of transportation between the two cities, to the utmost economy, consistent with dispatch and regularity, the effect of it must be to make the Pennsylvania Canal nearly as useful to us as to Philadelphia herself. And when the Erie Rail Road shall be made, the consequence of such cheap conveyance must ultimately be to bring freight from *Philadelphia here to go west:* because it will save *five days* in the passage to Pittsburg.

Thus in effect extending the Pennsylvania Canal to New-York, we (now,) at once want to be on a footing with her in respect *to water*, and the means of preserving the purity of the air of the city. *This therefore is not a precaution to be postponed for years.*

We have reached that point in this great competition, in which we contend, and must for some years contend, at so much disadvantage, that we cannot spare one, nor the *least one* of our natural advantages. Much of our trade must come to us through her from the west, and must not be *repulsed by danger*, into the lap of our rival.

If she has the Schuylkill at her side, from which she pumps her millions of gallons, and which we do not envy her; we have our pure subterraneous streams, which we can easily raise to the several eminences in this city. Do any doubt the actual presence of a great body of fine water?

To elucidate the question now pending before the community to be settled in the novel mode of a vote at the polls, the facts must be stated which prove the value of the island springs. Perhaps it were presumptuous to hope to remove the prejudice that has been industriously disseminated against the value of this remarkable gift of nature, which seems to render a costly work unnecessary, but some may be convinced that this mode of supply has not been advocated without *some reason;* whether to delay the supply four, five, or six years might not be a *public calamity*—it is for you to judge!

Admit for a moment, before I shall have proved it, that there is in the stratified rock of this island, and northern range of hills a natural aqueduct, giving an abundance of such fine water as that which has been produced by borings, and is known through the city as *Rock Water;* and suppose that every advocate of the temperance cause were able to refer to the salutary effects of the habitual use of this pure water, if these benefits should last but five years, till a substitute could be brought in from the Croton, would it not have been worth while to open forty fountains, even if they were then by ordinance to be *closed for ever*, that the Croton aqueduct might receive a revenue? But would the *water drinkers* be willing to have them closed? Is the temperance cause to be promoted by excluding rock water and introducing *brook* water, such as the inhabitants of Putnam will not drink? The rock water is soft, light and cool, it requires no ice and filtration. The success of the temperance cause in New-York does not depend alone on having this pure water, but would it not be greatly aided by its diffusion?

Why has the city been always so insensible to the value of this gift of nature, certainly a very remarkable one to an island city? The reason has been that some influential individuals have had an interest contrary to its reception, and the people at large have not understood its value. And because the instrumental means were the invention of a mechanic. But where do we see any very useful improvement, that is not likewise

the invention of some mechanic? This should rather have been a reason for encouraging it into general use. The Committee of the Common Council will appear to have been ill advised.

Will the inhabitants of New-York be content with other than the finest spring water since it has been given them? Will they, because the people of Philadelphia make the best of their Schuylkill, and London of her Thames, see reason to give it up and be content with brook water after it has drained populous districts?

Does not the good sense of the people teach them that water to be wholesome must be *cool* and *soft*. Has not the Creator taught this in the manner in which he has beneficently prepared it by evaporation and condensation, sending it from the mountains down to the habitations of man in the channels of the rock or earth, beyond reach of the causes of contamination on the surface, and the dangerous deposition therein of the *eggs of insects*, which are known to be left in running water in the warm months in immense numbers. These being swallowed, are absorbed into the blood, the warmth of which hatches them out. A case is stated in the *New-York Medical and Surgical Journal for August* last, describing a person attacked with fever, in whose blood (that is, in the few ounces drawn,) there were found 28 active worms from one half to three-quarters of an inch in length. Mr. Rhinde, a naturalist in the vicinity, found them to be the larvæ of the tupula fly, of which the ova had been swallowed in drinking the water of a small river. And it is very likely that this is among the unknown causes of *fever* in many instances.

To understand the subject of water, it is of use to advert to the provision which originally and spontaneously existed here.

In the central valley there were two ponds, one of which the Collect, between the Park and the Bowery, was *a mile in circumference*, and very deep, the rains which fell on the island could not account for it: and the quality of the water was that of a spring, and not of a rain-water pond. Its *coolness* was the popular objection to its being abandoned and filled up, in order to bring in the running water of the Bronx. Lispenard's pond, half a mile north west of it, was of the same quality. The former was calculated to be sufficient to supply the whole city:

Whence came this body of cool water?

The geological survey made by Professor Eaton, by order of the Hon. Stephen Van Rensellaer, from Syracuse to Boston, ascertained the fact, that the primitive rock, always in layers, spreading down from the west, after underlaying the valley of the Hudson, slopes up, and forms an extensive range of hills beginning with the island of New-York, and extending north through West Chester, Putnam, Columbia and Berkshire, pouring out innumerable springs from between the layers. The like spontaneous outpouring formed those basins.

Now, as this range of stratified hills, was the explanation of the natural basins of water in this city, I would ask every man of reflection whether the *same springs* that fed them, must not continue to flow? *Whether it is possible by filling up to suppress a living spring?*

That they still flow is proved by finding water in the rock when bored, rising with much energy 20 feet higher than their surface, and 30 feet higher than tide.

And that a great quantity of this fine water still flows out of this extremity of the rocky range underground, is proved by its being found in quantities that no pump can reduce nor fire engine exhaust, as often as an *iron tube* is set down 100 feet in the earth any where at the foot of

this under ground hill of rock. There are sixteen or twenty such instances. How natural it would have been to supply the southern wards from the base of the northern hill!

The boring in the rock at Shaw's garden near the Deaf and Dumb Asylum, is 112 feet, the water rising freely 94 feet, is the most elevated; but the most useful is Mr. Underwood's in the ninth ward, about 100 feet deep, 2½ inches diameter, which with some springs in that neighbourhood, continually supply the city with table water. And in the same neighbourhood that of Mr. Richards in Perry Street, 200 feet deep, of which 130 is in rock, has given a constant supply to his establishment night and day of about 20,000 gallons in 24 hours, cool and delightful to drink, its very purpose requiring it to be soft. Why should there not be any number of such?

That of the Manhattan Company, at the corner of Broadway and Bleecker-street, is the most remarkable for its depth and size. There is, first, a well 12 feet in diameter and 40 feet deep, down to the rock: this well has a considerable quantity of *hard* water. The boring is commenced on its rock bottom, and is carried down 400 feet 7 inches diameter. Water was found at 282 feet, and successively *nine times*. The full quantity it will afford has not been ascertained, but it is certain it keeps a six-horse engine at work for weeks together, or as long as they please; and that the quantity which this power raises, with temporary works, is 90 gallons a minute, or 129,000 in 24 hours. It is of a soft and fine quality, precisely like that at Perry-street, and has been used in families for washing clothes. But not being got easily separate from the hard water of the well, because the latter must be previously pumped out, the commissioners must have inadvertently given some of this mingled water to Mr. Chilton to analyze.

This boring will yield enough for one ward. It actually cost 10,000 dollars, 15 would cost 150,000 dollars.

But why has not the water been distributed? The answer may be, that as there has not been, for a long time, any cessation of effort or project to bring in water, in violation of the charter of the company, they may have felt at liberty to pause in their expenditures. There surely can be no better object of capital than an inexhaustible source of pure water in the midst of a dense population. It is not to be believed, that if they had the rock water in Philadelphia, they would drink even the filtrated Schuylkill. Why should we not feel a pride in our *superior* quality of water?

The incorporation of that company, to bring in the Bronx, when it was determined to fill up the Collect, necessarily gave them a control over that and other streams beyond the island, and a perpetual existence. The powers of a bank were made incidental, and since confirmed by the Supreme Court. But as there was not then known to be any source of pure water in the island capable of supplying the inhabitants, the intention of the act is manifest: and possessing no exclusive privilege in the city, the ground they have not occupied is the proper field of enterprise for another company.

The rights of parties being admitted, according to law, then the inhabitants of New-York have a resource in *the rock water*, independent of litigation. It would have been only requisite that the common council should have given leave, as petitioned, to lay down pipes, and the Rock water would have been distributed; and the common council might have raised as much as public purposes required, as they now can, at small expense.

The two objects should always be *distinct*, because for public uses the demand is at times excessive. For private use, the supply requires to be *steady and calculable*. No plan can better assure an uninterrupted product than a number of sources and engines combined, yet separable. They would be like the numerous water wheels at Philadelphia, and their parallel main pipes and separate reservoirs; but when a city depends on *one duct only* of great length, there is, in our climate, great liability to interruption.

Besides, you perceive that in filling up the Collect, which was estimated at two millions of gallons a day, they did, in fact, protect this water from contamination. The pond was very deep; on both sides the valley there were high gravel hills which were to be dug down to fill it up; and as the embankments advanced into deep water, they were high, so that the stones among the earth must have separated and rolled down, covering the whole bottom of the pond many feet deep, surmounted with earth perhaps fifty feet.

Now, can any one doubt, that if an iron tube had been set vertically in the middle of the pond, and surrounded by the filling, that the water would have stood in it at the original level; and that a pump or steam engine would have found an inexhaustible source, because the springs which had fed the pond must have then flowed among the stones to the tube?

If then, one or more pipes be placed in by the process of boring, the city has recovered that water as *effectually as if they had been previously set in*. Here we might have four millions of gallons a day; for that the same command of the waters, now subterraneous and protected, of Lispenard's pond may be had, is evinced by the boring and tube at Cram's distillery, where, on taking off the upper joint to bring the top lower than the *ancient level*, the water continually overflows, cool and pure.

If the city then, still possesses these *original* sources, why may not water be raised from them to the high ground near the Park, and near Chatham Square, in abundance for the fire engine service, and the cleansing of the streets?

The foundation of boring for water in the middle states, is the geological formation of the country, the position of the rock, the parting of the strata which must have been for many ages the channels of water from the mountains to the sea. The expectation of finding much water at Boston by this means, was not justified by the geology of that part of New England, as the inspection of Eaton's map will show; and the reference by the commissioners to little success there, is answered already by great success here.

This want of accurate information has, indeed, been the cause here of the prejudice which has been implanted and propagated. The Committee of the Common Council, on providing water for the fire engine service, desirous of establishing a tank on high ground, addressed a respectful inquiry to the New-York Lyceum of Natural History, as a society, whether boring for water could be relied on to fill their tank?

It was respectful in the committee, that, instead of inquiring of experience, at the several places above mentioned, they submitted the question, not to a geological society, but one cultivating a different branch of science, but so composed that it might be assumed, that, like their great predecessors, Newton and Bacon, they must not only know facts, but respect experiment.

Looking, as they must have done, at the surface of the island, there may be an obvious apology for their opinion, that boring for water could not be relied on, because the strata seem to stand upright.

Thereupon the committee of the common council proceeded to excavate the corporation's fire tank well, 16 feet diameter, at 13th street, the surface of the rock being 13 feet under ground. But the excavation had not proceeded more than one diameter before it was plain that the strata was not vertical, but at an angle of 35 deg.—much as had been described in Professor Eaton's survey, which was probably not then known to those gentlemen.

But, notwithstanding this mistake, the opinion of the learned committee has been *quoted in the commissioners' report*, as *of authority*, contrary to fact; though, we presume, not with their consent.

The principle on which boring for water is founded being true, it is a resource for pure and cool water of inestimable value to our cities in the middle states, since the invention of apparatus to reach it.

The committee on fire and water next directed the late Col. De Witt Clinton (Nov. 1832) to survey the country, from White Plains to Croton river, and give his opinion of the best mode of conducting the same to the city: and on the 22d December they received his report, recommending an open aqueduct, estimating the expense at two and a half millions. —His opinion, in rejecting the Bronx, expresses disapprobation of the *brick tunnel* proposed from that river, and gives some striking objections, (page 238) to this kind of structure, applicable to the present Croton project.

The Committee having reported in favour of obtaining the appointment of a Board of Commissioners, to ascertain the best plan of the work as the basis of their application for leave to borrow the sum requisite, the first board was appointed. They (the second board being appointed by the Legislature without application), procured a mature plan and estimate of an aqueduct from the Croton; and had not the Board thought it necessary to the acceptance of that plan, to *depreciate the island sources*, and consider the city as having *no good water*, there would have been no occasion for comment; but it has become incumbent to point out in what respect they have done injustice to the owners of real estate; and may have deprived the city of a *timely resource in the present exigency*.

The obviously proper mode of proceeding would have been to inquire into the cost and products of the several borings in the city: and if for example they had asked Mr. Richards, they would have found the cost of his to have been about twelve hundred dollars, and the product 18, to 22,000 gallons a day, more even than the Corporation's well that had cost eight times as much; but they pass it over slightly as a "well," and do not draw the favourable inference they evidently might from this instance as a boring of the rock. But they wish to find some occasion to discredit this art and resource. When they came to that of the Manhattan Company they found evidence that it was capable of giving at least 120,000 gallons a day; and they might have learnt the expense of working their six horse engine, and thus have had accurate data.

But their mode of proceeding was, to *imagine* the great *well* of the Corporation, *a boring*, and to say against borings all they could say against this work. Whether this was judicious or candid you will be best able to judge.

On this plan they gravely proceed, and say, page 371—"the well sunk

by the Corporation on 13th Street, although a very useful project, has been a very expensive one to the city, having cost, including the land, 57,972 dollars." It must have seemed to the Board wonderfully costly, as by mistake they had swelled the amount no less than 15,739 dollars.

Nor would it be now worth while to have mentioned this trifling error, if it had not been in their calculations against the island sources, afterwards multiplyed 42 *times!* and if they had not in their recent report referred the Common Council to all they had said in the first, on this subject, as being *true*.

Having thus established the principle of their computation, and determined that a work made for the *special purpose* of holding in readiness to extinguish fires 233,000 gallons, not comprehending (then) a boring, must be a proper example of a simple station to raise and allow the water quickly to flow to the consumer, they *proceed to calcutate*, but premise that "the Commissioners have no data by which to estimate the cost of the Manhattan well (i. e. boring), if put in a situation to distribute the water with engine, reservoir, &c., similar to the well of 13th Street, but they have no reason to think that it will be less than that belonging to the Corporation."

If the Board then were of this opinion, what were *the items* of its cost? Will they justify that opinion? They were as follows—

Eleven lots were bought partly on speculation, of which two only were essential to the establishment	$12,250
The cost of blasting out the well	9,000
The iron tank 44 feet diameter, 20 feet deep	4,200
The foundation	4,415
The building	5,041
Its foundation	1,377
The steam engine	5,200
The shed	750
making	$42,233

It is plain to every mind, that among all these items there is no other applicable to a station but the steam engine; and that if the board had been very anxious to be accurate, in a matter not strictly within their commission, but interesting to the owners of real estate, they might have said that *one lot* is alone necessary,

cost, say	1200 dollars.
The engine and pump	5200
Its shed	750
To this they might have added	
The cost of the Manhattan boring	10,000
And a cistern and building	2,850
making	20,000

This surely is very different from the accidentally exaggerated sum they state; for it cannot be supposed that *gentlemen of character* designedly made such a mistake.

And now, wanting a number wherewith to multiply the said 57,972 dollars, they assume that there actually is *no water in the island at all* fit for even a horse to drink; and there must be provided 5,240,000 gallons a day—(which demand being now, however, answered from some source or other, seems to prove that the city is not really so destitute as has

been supposed.) To ascertain, however, how many borings would supply the whole, they take the product of the Manhattan at 120,000, and divide it into the above quantity, and get 42, as the number of *boring stations* necessary for the whole city.

They then multiply 57,972 dollars by 42, and find it 2,434,824 dollars, the amount of capital required, according to them. Finding, even with all this exaggeration, (accidental no doubt) that the amount was not half so much as the Croton aqueduct, they bethought them, in the face of experience, of saying that because one boring or 100 borings succeed, that therefore another will not. But can there be any reason for doubting success when the geological formation of the country itself promises it, as surely as that the branches of the Croton will continue to flow? They come from the same rock.

A proper comparison would have been, to take the aforesaid 20,000 dollars as the fair cost of a station, and multiply that by 42, which makes 840,000 dollars, as the utmost capital for the whole city, were there no good water in it. About one third the sum they compute to be necessary for the 42 stations, and about one sixth as much as the Croton aqueduct will cost, exclusive of distribution.

But finding their own calculations would not justify the rejection of the island springs, they assert that the *annual expense* of them would be greater than the interest and management of the Croton aqueduct.

And how do they make this calculation? First, they state the interest on the exaggerated amount, at 5 per cent. is.....121,741
They then calculate the annual expense of a 12-horse engine to be 5569 dollars, which they multiply by 42 stations, making 233,937

Together.....$355,678

But here again they make another great mistake. It was a *six horse engine* which raised the 120,000 gallons, by which they divided the whole demand. Therefore the last of these large sums is *nearly twice too large*, on their own system. On their side, they assume that the aqueduct will cost five millions, and that five per cent, will cover not only interest, but repairs and management. But when and where was it ever known that the expenses and interest of this kind of property was covered by less than *eight per cent?* So that if it cost no more than five millions, the annual requisite income must be 400,000 dollars. Indeed including the distribution 6,200,000, would be 496,000 per annum.

We do not see where this revenue is to come from, unless by direct taxes, whether the inhabitants want the water or not.

The calculation of the expense of raising water by the steam engine depending on the height, to which it is raised in a given time, and there having been various modern improvements, I am sure it would fall materially below the following estimate which I make in this way, as in some relation to the Erie Rail Road.

For example, the locomotive known on the Baltimore road as Cooper's of New-York, would do one third more work as a stationary engine.

Its performance is forty miles out and back in four hours, carrying fifty tons: though near the summit the rise being thirty-six feet in a mile, the rate is but ten miles. It consumes one ton of anthracite coal in that time, so that the cost of fuel is three-tenths of a cent a ton a mile. This engine is calculated to be at least a thirty-two horse power.

Now such an engine employed in pumping, would raise at least 850 gal-

lons every minute, 100 feet high, which is above one million in twenty-four hours: we shall however probably not require it to be raised more than fifty feet high, in which case it will raise two millions.

If it consumed six tons a day it would be	$30	
double hands wages	6	
charges	4	
	$40	
Allow the work to be 365 days, the amount is		$14,600
Interest on the establishment 20,000 at 6 per ct		1,600
Supervision		300
		16,500
As much water is thus raised as 10,000 families require, and the aqueduct will average $40 a house, or $400,000; the Interest at 8 per cent, on which is		32,000
Making		$48,500

which is for cost of this mode of supply, $4 85 cts. a house per annum.

For public uses, fire, and health, the capital actually invested need not exceed 50,000 dollars. To provide water for the streets and fire tanks, derived from the Central Valley, the annual expenditure of 33,000 dollars will raise two million gallons a day, for public uses, one hundred feet high. This would be less burdensome to the people than the interest of the public debt proposed to be created.

It is reasonably doubted whether a general water tax can be constitutionally enforced. The Corporation may supply water at common charge for fire and streets, but not for families. To receive water must be optional, because there are many who have excellent wells, and who have shared in the expense of borings and tubes. Many may be content with the Manhattan Water Company, when they distribute the rock water. Like bread, it is aliment, and an ordinance may regulate the weight; but no man can be compelled to buy.

As the natural sources cannot be suppressed, it is probable that those who wish to give the greatest value to estates eligibly situated, will provide them with the pure and cool water of the rock.

I have thus shown that the commissioners, not feeling that the sources within the city were strictly a part of their commission, did not go into the examination thereof, as if it were a subject in which the inhabitants felt any interest; but as agents of the Legislature, pass it slightly over, and leave the impression that it is not worthy of any acceptance as a gift of nature, while, in truth, as I have demonstrated, if properly understood, it must prove an obstacle to any extravagant plan of supply from the Croton.

They fear the influence of a just estimate of this resource, and therefore fall into the erroneous calculations which have been exposed to view. The injury is *to the owners of real estate;* unless their good sense should seasonably correct it, in rejecting that plan.

And if the plan of the Commissioners were rejected, would the city have the power to substitute a better? It appears to me so, because there can be no positive certainty of the delivery of the water from such

a distance continually, in any other than in iron pipes. But commissioners and engineers have said that these are out of the question, because they would cost twelve millions. But why out of the question? because they have assumed that the city now wants twenty millions of gallons a day; but why should more be brought in at present than is necessary?

They estimate the expense of forty miles of thirty inch pipe to be 2,796,400 dollars, and deliver about three millions of gallons in twenty-four hours, with a fifty feet head: a higher head will deliver much more. This method would be unaffected by climate or time and, would be worth the cost; but an aqueduct in hydraulic masonry, subject bsides uncertainty to repairs from year to year, would not be worth cost; and how else is the debt to be redeemed?

I would not be understood to say, that the plan of the work is not the best which engineers could, under such constraint as to expense, have devised; but it may be said, that there are objections on principle to the conduit of water for the supply of a city in one duct only, if that one be liable to interruption; also, without example, that an aqueduct be made in masonry in such a manner as to be liable to disturb its own foundation, or settle in the least degree, because the consequence is, that the trunk necessarily cracks; leaks may occur to disturb the ground; much of it will be on embankments, which we know settle for years on railroads and canals. The route is on and in stratified rock, and the aqueduct may leak without its being detected.

It may be urged that we know from experience in our country and climate, how generally works in hydraulic lime are more or less leaky. The degree of leak, which would not be regarded in a lock or canal aqueduct, becomes of serious consequence in an aqueduct of supply from so great a distance; in forty miles thousands of minute leaks may reduce the water too considerably. There ought to be *no* leaks, because not being out of the reach of frost, ice may form externally, and press the masonry out of place. The trunk being laid in many places immediately on embankments, there is no certainty that settling will not combine to disturb the good order of the work; and Col. Clinton says, in his objection to Mr. White's proposed *brick aqueduct*, that in case of any break in *winter*, it could not be repaired till the ensuing summer; none of these objections apply to iron.

Having seen the aqueducts of Rome, I venture to say that no point is more scrupulously guarded than that the foundations of the trunk shall not be disturbed by any accidental break or leakage.

If we had perfect certainty of our masonry, perfect guaranty against the climate, sometimes severe, and against heavy rains, baffling skill, and involving great damage, a trunk of masonry might do.

Were there no good water in the city, and it were desirable to bring in four millions for drink and culinary uses, and that eight millions more were wanted for the use of manufactories and horses, and for washing streets, the former might be brought in one iron pipe, laid in an open walled canal, serving to bring on the rest; and when the city should require another pipe, it could be laid by the side of the first. This would be a *sure* way to accomplish each object at a moderate expense.

This would provide the greater proportion for common purposes at so much less expense, that it could be afforded much lower to all the manufacturing establishments. There is no difficulty in delivering them separately from distinct reservoirs.

In regard to the revenue of the Croton aqueduct, it cannot be lost sight of, that the Manhattan Company is a perpetuity, and that its charter rests on delivering good water to those who desire it along their aqueduct; and it may be presumed that they will make their works extensive enough to yield a revenue equal to the expense and interest. This institution must supply, therefore, a considerable number of customers out of those the Commissioners have calculated on.

We must deduct, also, those families who are willing to pay for a full quantity of rock water, which can be afforded by the barrel daily per annum, at about double the expense by pipes. If, however, some want to economize still more, a rock water hydrant may be at every corner of a square of which the occupants unite to take it, if pipes are used.

As a temporary precaution, it would be easy to contrive that every pump in the city should discharge a gallon on the street, every time a bucket is pumped.

It seems imprudent to defer a system of cleanliness, so essential, till we can bring in the Croton water.

It is disadvantageous to the manufacturing interest of this city who are solicitous to be supplied, to postpone that accommodation from four to eight years. If the water be on the island, why should they not have it immediately? time is every thing in business.

That an immediate attention to cleansing the streets is of far more consequence than is generally suppsoed, will be at once seen by adverting to the latest and most philosophical doctrine on the subject of *malaria*. The necessity we are under of converting the streets into sewers, makes the true understanding of cause and effect interesting to every one.

Malaria has been mentioned, in Professor Dunglison's recent work on human health, as being well described as to its origin by Dr. Caldwell, in his prize essay, who considers this source of danger, not as putrefaction, or the separation of bodies into their elements; but from vegetable and animal matters in a state of *dissolution*. "Bilious fever in all its varieties of type and degree, often prevails in places where no putrefaction is discoverable; but dissolution, by which I mean the decomposition of dead organic substances, and the reunion of the elements producing new compounds, is present. In no other way can malaria be formed."

Now, as the streets of this city are the receptacles of such substances continually, it would avail little to let on water in the expectation of sweeping it away. This might cause much filth from the higher streets to lodge in the lower; but as the broom always leaves the most dissolved and dangerous substances, some water is wanted to naturalize their products. The broom cannot be dispensed with; but if the sweepings were towards and into the gutter, and forthwith removed, the fresher dirt would absorb the *dissolved and poisonous* part, and take it off more effectually than the broom alone; we should then escape also the annoyance of dust. Little water then following would neutralize the remainder.

When it is recollected by every one what great numbers are carried off by pulmonary consumption, and how many of these cases originate in preceding *intermittent* or *bilious* fevers half cured, the state of the atmosphere of the city, it would seem, demands the most immediate remedy.

It seems to have been from the beginning an error in this branch of public economy, that the *present* has been sacrificed to the future. And it is to be rather expected, that the public authorities will not be convinced of the existence of the island sources, till they see either the Manhattan Company or associations of private citizens availing extensively of the rock water.

Although nature, theory, and practice, combine to establish the fact, that the water is here; yet the Board, appointed mainly to investigate *how* the Croton water should be brought in according to the predetermination of the first Commissioners, have found it to be their duty to merge this primary branch of the inquiry under the weight of their great influence. The commissioners know that the city would never consent to bring in the Croton, unless the work were believed *necessary*. Having persuaded themselves in the way I have explained to think it so, they have endeavoured to persuade others; but the main facts on which alone the community can form a correct judgment, were not stated at their value.

It may be hoped that the Corporation, anticipating the improvement of Central valley into the great Erie Rail Road landing, whence level ground leads to both rivers, convenient positions will be assigned for raising the recovered spring water to embellish and protect this future thronged mart of the great west; and at once provide for the fire and health departments, the manufactures and shipping. If in 1798 this source would give two millions of gallons a day, it will do the same now.

Without interfering with the Manhattan Company, the inhabitants of the southern and shore wards might form a water company.

The *northern central wards* another, in order to give the best quality of water to the quarter of the town enjoying naturally the purest air; and of which the eligibility for the most costly dwellings is equalled by no other place in the Union. To give perfection to this elevated part of the city, it seems only wanting that they should unite to command an independent source of supply of water of the finest quality.

Let us however admit that it may possibly be found desirable that there should be a more free command of water for health, fire and manufactories; it is plain that for these purposes an *open* walled aqueduct from the Croton would be admissible; and would cost about half as much as the proposed aqueduct in hydraulic masonry, while families would be supplied at small expense from the natural aqueduct of the rock. A work of this magnitude should not be experimental, but on some sure principle.

In summing up the advantages of this natural course of proceeding; the effect is that the public respects the chartered rights of a company earned by the investment of 400,000 dollars, and which probably stands ready to make it available when it shall be decided that those rights are not to be infringed. This Bank is left in a position to countervail as is requisite, by the credit which attaches to a perpetuity, as soon as the Erie Rail Road shall be made, the previous adoption of the capital of the United States Bank into the internal commerce of Pennsylvania; for there is no doubt that to maintain our commercial and political influence as a city and a state, the banking capital of New-York must bear some proportion to the relations of this port with the interior.

Another advantage will be, that instead of a great public debt prematurely and unreasonably bearing hard on *real estate by taxes*, which must be levied to make up the deficient revenue, the public debt will be small, and substituted by private capital, to which the Common Council will add as much as they please to give the Corporation proper influence in the affairs of the companies; and that every encouragement may be given to the manufacturing classes:

Another is, that if it be determined at some future time to bring in for

them, and for health and fire a duct from the Croton, it may be executed more economically. Thus inviting the fullest confidence that any number of manufactories to be possibly expected, will be accommodated one way or the other, present and future.

Another, is the great point that we shall in one year be on *a footing with Philadelphia* in respect to safety.

In conclusion, the inherent difficulties of executing the law appointing the second Board of Commissioners, have at the outset made it necessary to depart from the *condition of its validity that the cost should not exceed two and a half millions*—and that this should be ascertained by *contracts*, which they admit no one would make. The law being passed without request of the Common Council, is of doubtful constitutionality. Can it be consistent with the city charter? Does it not institute an agency of the Legislature to execute a *trust* which should be done by an agency of the Common Council? As it now stands the legislature has commanded the Common Council to raise money for this agency, which is in no respect responsible to the city or its officers, and is moreover a *permanent body for city affairs* existing at the will of the Legislature.

Is this the commission which the Common Council reqested? The Fire and Water Committee evidently did not intend to surrender any part of their delegated authority, nor had they the power to do so. The charter belongs to the Corporation of the city; and if the Councils occasionally need special powers, as that of raising money, it by no means follows that the Legislature, because it can enlarge, can also diminish those powers vested by charter. Such are the writer's own impressions. If the water commission be not consistent with the charter, it materially affects the rights and interests of the city, as such, without any reference to persons or party.

Should not so large and wealthy a community, necessarily governed by councils vested by charter with all competent powers, be jealous of the first encroachment on it? Is it not the ark of our safety?

The Legislature having refused to aid the Erie Rail Road Company, it may become a question whether there are not good grounds for believing that this work would be an investment worthy of a full subscription by private capitalists?

If every section opens some peculiar source of revenue, and if the road *leads directly to the centre* of the west, as well as to the northern internal coast of our country, growing rapidly in improvement, it would seem that there should be no doubt.

The first section includes the manufacturing establishments of the Ramapo valley, of which the neighbouring mountains abound in iron. After passing half through this remarkable gorge in the highlands, there opens a direct valley to Newburg, to which a branch would be easily made; and perhaps in time be prolonged to Albany for a winter road.

From the Ramapo the route inclines north west to the centre of Orange Co. To the west through Sussex and Warren, the ground is favourable for a rail road instead of the canal formerly projected to the Delaware. These counties abound in iron, limestone, marble, and produce. The Delaware here breaks through the Blue Ridge, and from this place to the Susquehanna a rail road has been authorized and the company formed: the surveys and estimates made. It crosses elevated but favourable

ground, and descends into the lower part of the coal valley of the Lackawana and of Lyoming, ten miles above Wilkesbarre; at the great turn of the river from the north-west to south-west. The execution of this work will give great accessions of business to the first and second sections.

The third section reaches the Hudson and Delaware Canal, and during winter the rail road would receive coal to be brought east, and all the year to go west. The trade in lumber would also be considerable from this section in the winter months.

The fourth reaches the north east branch of the Susquehanna, meets and accommodates the trade and travel of Otsego County, and passes along the southern border of the state, facilitating the business of the country on the upper branches of that river for two hundred miles.

The fifth section reaches three objects, the winter trade of the Genesee Valley as low as Rochester; and the bituminous coal region of the Alleghany; and the direct navigation to and from Pittsburg.

The sixth, leaving the Alleghany valley, reaches Lake Erie through a rich tract of country.

In relation to the comparative expense of transportation from New-York to the river Ohio, by the way of the Erie Canal, or by the way of *Alleghany River and the Erie Rail Road*, the recent report of Mr. Johnson, published in the Rail Road Journal, leaves room for a supplement. He expresses the opinion, that the Rochester canal, lately surveyed and reported by Mr. Mills, will not interfere with the interest of the State, in which he is no doubt correct, nor will the Erie Rail Road, though capable of affording much cheaper conveyance.

The distance from Olean to the Erie Canal is 90 miles.
From Rochester to Albany is 260 miles.

350

at the same rate as on the Erie Canal (though no doubt it must be more, from the greater lockage,) is ------ ------ $17 70

New-York to Olean 400 miles by Rail Road at 1½ cent is 6 00

The statements in his report seem to require to be carried out in their respective ratios, and the expense of transportation on rail-roads, when in good operation, added.

It requires that each rate should be extended from 1000 lb. to that for a ton, in order to conform to the established standard of measure.

Taking the rates therefore as stated by him as the customary charge, we have from New-York to Albany 145 miles, $2 37 per ton for heavy goods.

By Erie Canal ---- ----	363	18 37
To Cleveland by Lake ------	190	7 98
Ohio Canal ---- ------	308	15 58
Making		$44 30,

deducting the less ratio practically on Ohio Canal, and we have their customary charge of $1 86 per hundred lbs., which is $39 66 per ton *to Portsmouth.*

Let us now calculate what the expense will probably be from New-York by the Erie Rail Road and Alleghany River also to Portsmouth.

The expense of carrying on a Rail Road depends in some measure on there being full business. At first, as at Baltimore, when the extent is small and the landings to be attended at as much expense to the Company, as if the business were full, the charge is rather what people are content to pay, than what the transportation could be afforded for. But

on the present occasion we may state what the Erie Rail Road will probably be able to afford when in good operation at maturity.

If we refer to Booth's report on the Liverpool road, page 85, it will be seen that the expense per ton per mile, is the equivalent of one third of a cent. If we ask what is experience at Baltimore, the answer is, that their locomotives carry forty tons eighty miles, for one ton of coal in four hours, which may be called the third of a day, coal $6, wages $1, oil 25 cents, interest on capital and repairs according to experience in England, 40 cts, making $7 60 cts; plus water stations $2 50, together $10 10 cts; divided by 3200 tons one mile, the work done, is ⅓ of a cent a ton a mile.

But lest practically in general this should be too small, let it be called one-half a cent, and the result will be as follows.

From New-York to the navigable head of the Alleghany is 415 miles, at ½ a cent a ton a mile, is ------ ------ ----	$2 07
Allow at maturity that the toll is one cent a ton a mile.	4 15
Alleghany River has a fall of 2½ feet a mile, which causes a current varying in velocity with depth, and if we assume the mean depth to be five feet, and the fall 610 feet to Pittsburg, may be calculated at about the average of two miles an hour. But without making any account of this advantage, 280 miles, at the same ratio as from New-York to Albany, which is giving up also the cheapness of coal on that river, and it will be to Pittsburg	4 59
From Pittsburg to Portsmouth 355 miles down the Ohio, at the same ratio as on the Hudson, is ------ ---- ----	10 22
Cost from New-York to Portsmouth	$21 03

If we extend this calculation to Lake Erie, 154 miles further, it results, that 569 miles at 1½ cent per ton per mile, is ---- $8 53

while by Erie Canal it is $20 75 cents.

Now the inference is very fair not only that the Rail Road will countervail the works of Pennsylvania, but will go far towards balancing the canals of Canada. We must expect that market to be supplied, but when we offer a facility in time, at moderate expense, there must be a great difference in the markets to carry much more thither than the ordinary demand will draw.

In adverting again to Mr. Johnson's report, it is perceived that from Philadelphia to Pittsburg, the charge in heavy merchandise is $1 25 cts. per 100 lbs., or $28 a ton. Light goods, $1 50 cts. per 100 lbs., or $33 60 cts. a ton.

Now as the ascent of Alleghany River by steamboats, properly constructed, will not be much more expensive than the descent, we will add one half to that estimate, making $6 88 cts, and add to this the Rail Road charge ---------- 6 22

Making $13 10, and we have less than half the expense to Philadelphia.

If the question arise whether the rail road will have full business, there are two or three general considerations which answer affirmatively. First, the prevalent demand for expedition in our country. This requisition has sprung from the circumstance of the great extent of the United States. To men of business who come a thousand or two thousand miles to our sea-ports, the intermediate country has little to interest them, and their thoughts are either in the market to which they go, or

the home to which they return. Nor is the wish to get over the ground soon, much less urgent with all; for however commodious steamboats and carriages are, they cause for the time idleness and restraint. Commercial calculation also always includes time, and all a merchant saves, in getting his goods *home,* is effectively an extension of credit, or use of capital.

On these grounds we see that the calculation of all *New England,* which must also come in for a share of the western trade, will be to join *Erie Rail Road.* It will be useless for Boston to make a Rail Road to Albany, when after reaching the Connecticut they can turn down through Hartford to New Haven, and by a steamboat transit of three or four hours, be on the Rail Road to the west. *All New England* is no small accession of business to that which the City of New-York will furnish, and the *central west* add to the north west.

It also seems to me that Mr. Johnson in his report has not quite done justice to the Chesapeake and Ohio Canal.

The elevation of the summit 3215 feet above tide, may be considered as balanced by the nobler dimensions of that canal, which permits of more than usual speed, and even the use of steam power, and it is probable that the summit will be crossed by perpendicular lifts instead of locks, which may save three fourths the time. This method is not indeed in practice, nor was that of inclined planes before the Morris canal was made. Nor is it certain that twenty feet allowed to be equivalent to a mile, relates to lockage alone; the tunnel will not be more than one mile.

New-York being as a commercial city also interested in that route, and it being very easy to adapt steamboats of considerable burthen to that and the other canals leading hither, we may compute the expense on the real distance in this instance as on the others.

We shall then have the Raritan 40 miles for navigation.

Raritan canal	43		
Delaware River	70	Delaware canal	16
Chesapeake bay to Potomac	100		
the Potomac	95	Chesapeake and Ohio canal	342
	305		401

The Hon. Andrew Stewart in his report to the Convention at Baltimore states that the dimensions of the canal, compared to Erie and Pennsylvania, are such as to make the effect of power as 171 to 100, therefore we must reduce the preceding rates in this ratio, which make it about three cents a ton a mile: 401 miles at 3 cents is $12

and 305 miles at the same rate as on the Hudson, is 7 26

$19 26

It is thus less expense from Pittsburg to New-York, than from Buffalo to New-York; and much less than from Pittsburgh to Philadelphia.

We thus see that the Chesapeake and Ohio Canal and the Erie Rail Road, are to be the cheapest commercial routes to the west, and the latter, the cheapest of the two.

It is evident that the Erie Canal cannot be a protection to the city of New-York against the policy of Pennsylvania. Her *political economy* held by public opinion above the vortex of party, has left the power of the state free to effectuate works of internal improvement generally.

They appear to have realized in their counsels, that useful as her canals must be to the commerce of her metropolis, they are far more beneficial to the heart of the state through which they are laid. It is the cheapness of conveyance to market which Erie canal affords to the districts through which it passes, that has built up the villages on its borders, and given increased value to lands, and not the transit of merchandise, to and from the west, in any considerable proportion. A rail road through the southern counties must have the like effect, without diminishing the business of the canal. It creates and opens the sources of its own revenue.

Some are of opinion that the refusal of the legislature is no misfortune, because the work is worthy of its whole capital, and if so the whole will be filled up. But suppose not, and still more money should be wanted, is it not better to rely on Congress to subscribe enough to complete the work? The western states are deeply interested in its useful effects, and there will be ample funds from the sale of the public lands.